Why Are Knowledge Graphs Hot Right Now?

August 2024

Amy Hodler
Founder and Executive Dir., GraphGeeks

Amy E. Hodler

10+ Yrs in Graphs

Author, Speaker, Graph & Network Science Enthusiast

amy.hodler@graphgeeks.org

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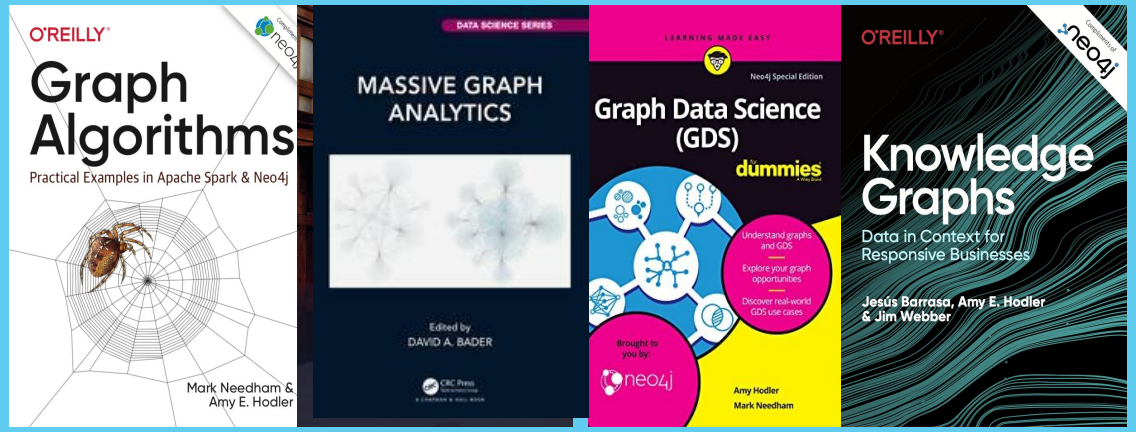
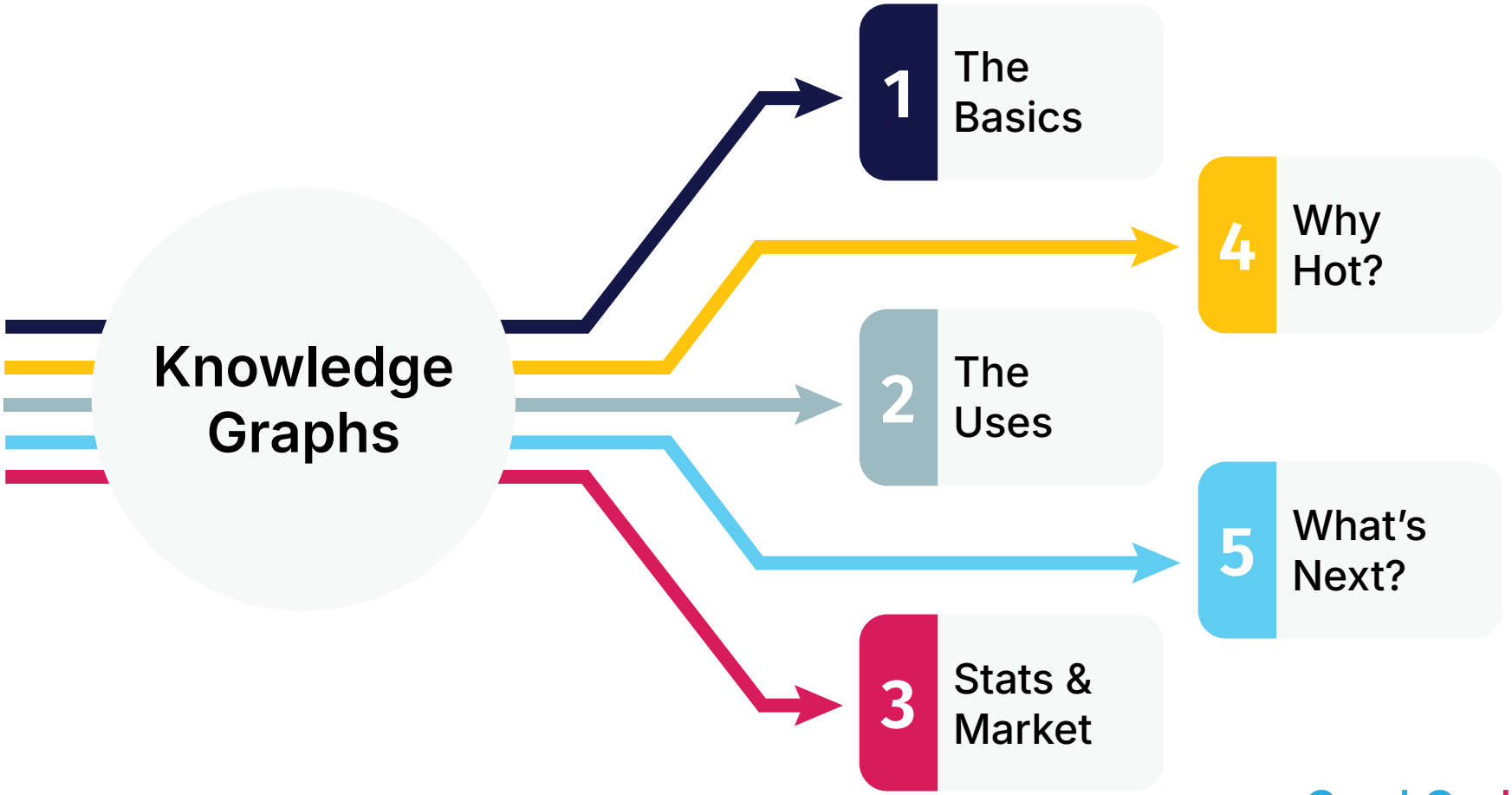


Hitachi Vantara - IoT
Cray - Graph Engine / Urika-GX
Neo4j - Graph Data Science
RelationalAI - Graph Analytics
GraphGeeks - Founder
Various Graph Startups - Advisor


Knowledge Graphs
1 The Basics
2 The Uses
3 Stats & Market
4 Why Hot?
5 What's Next?
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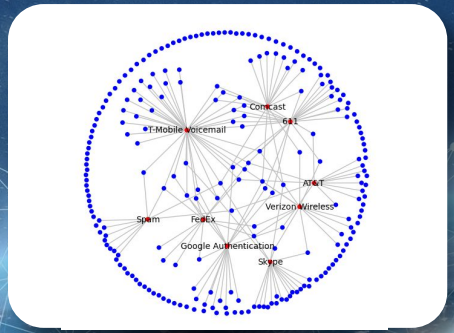
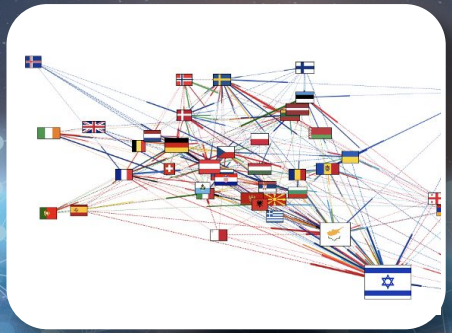
Knowledge Graphs
Make Use of Connections and Uncover Patterns



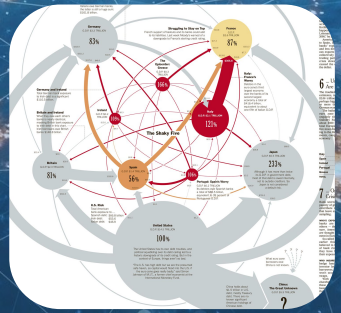
Communications

Transportation

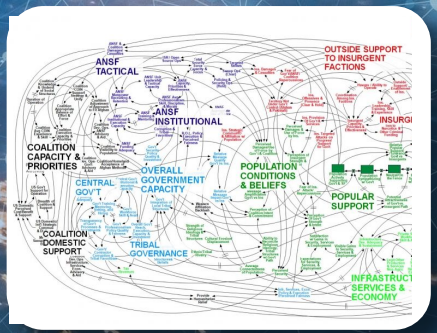


Social

Supply Chain



Finance & Banking

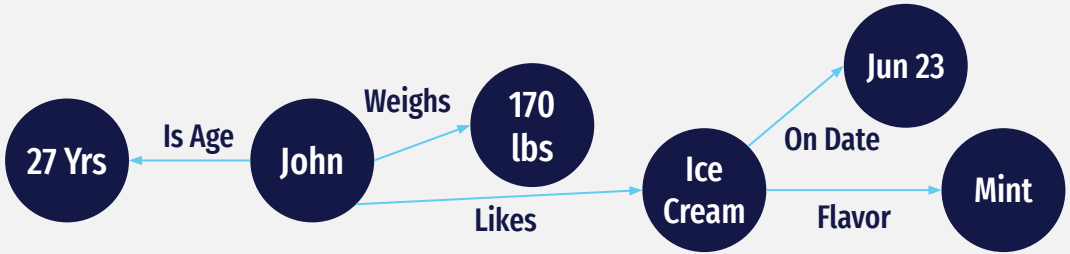


Security Ops

Graph - Any Model of Nodes and Relationships

Property Graphs
Have internal structure that can include many properties and is conducive to abstraction

RDF Graphs
Are semantically literal which is good for inference but can be verbose



RDF vs LPG Talk with Jesús Barrasa and Dave Bechberger
https://youtu.be/gMrxxt3n4mM?si=dFGU430E8iBsKm4q
www.youtube.com/@GraphGeeksOrg

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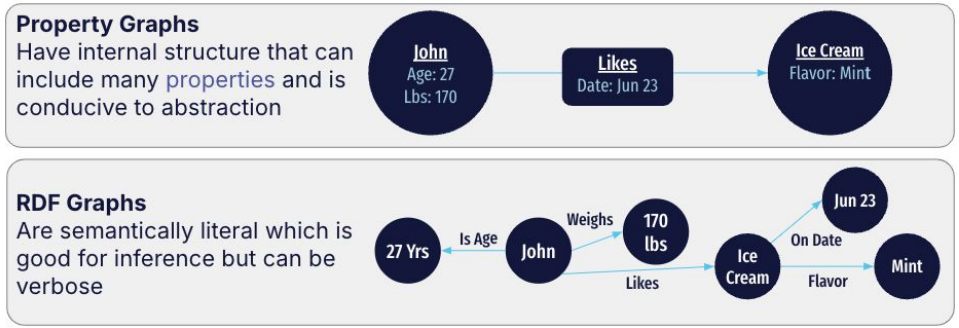
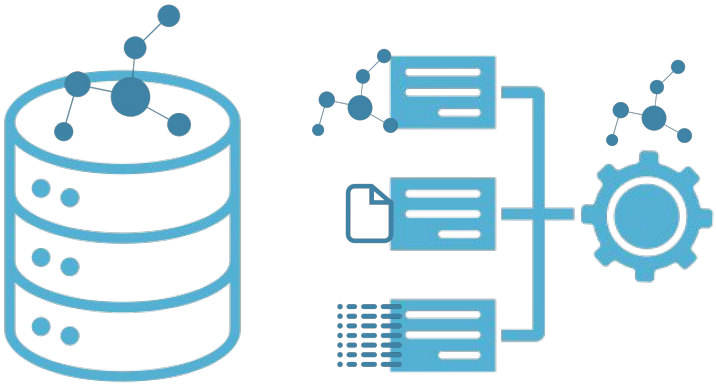
Graph - Any Model of Nodes and Relationships



Graph Database stores a graph and enables you to ask-answer questions



Graph Processing Engine Computes more complex graph analysis

Can be coupled with a graph database or non-graph data source

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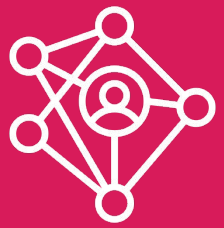
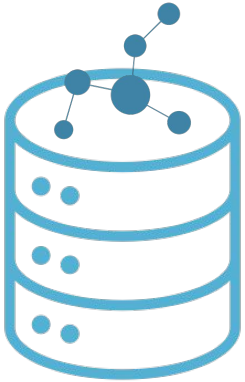
Graph - Any Model of Nodes and Relationships

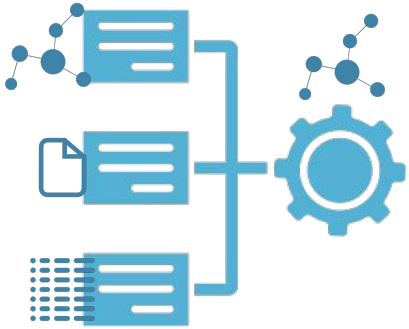
Knowledge Graph
An instance of domain specific information and rules that exists as a graph



My company, products, customers etc
Details on relationships & dependencies
Definition and rules about processes

Graph Database
stores a graph and enables you to ask-answer questions





Graph Processing Engine
Computes more complex graph analysis

Can be coupled with a graph database or non-graph data source

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Traditional Knowledge Graph Uses

Connected Data Overlay
"Integrate" silos for a domain
Data catalog/mgmt

Better Search
Semantics
Contextual relevance
Inference/logic

Human-Friendly Exploration
Serendipitous discovery
Iterative exploration

Decision Making
Holistic visibility
Planning & optimization

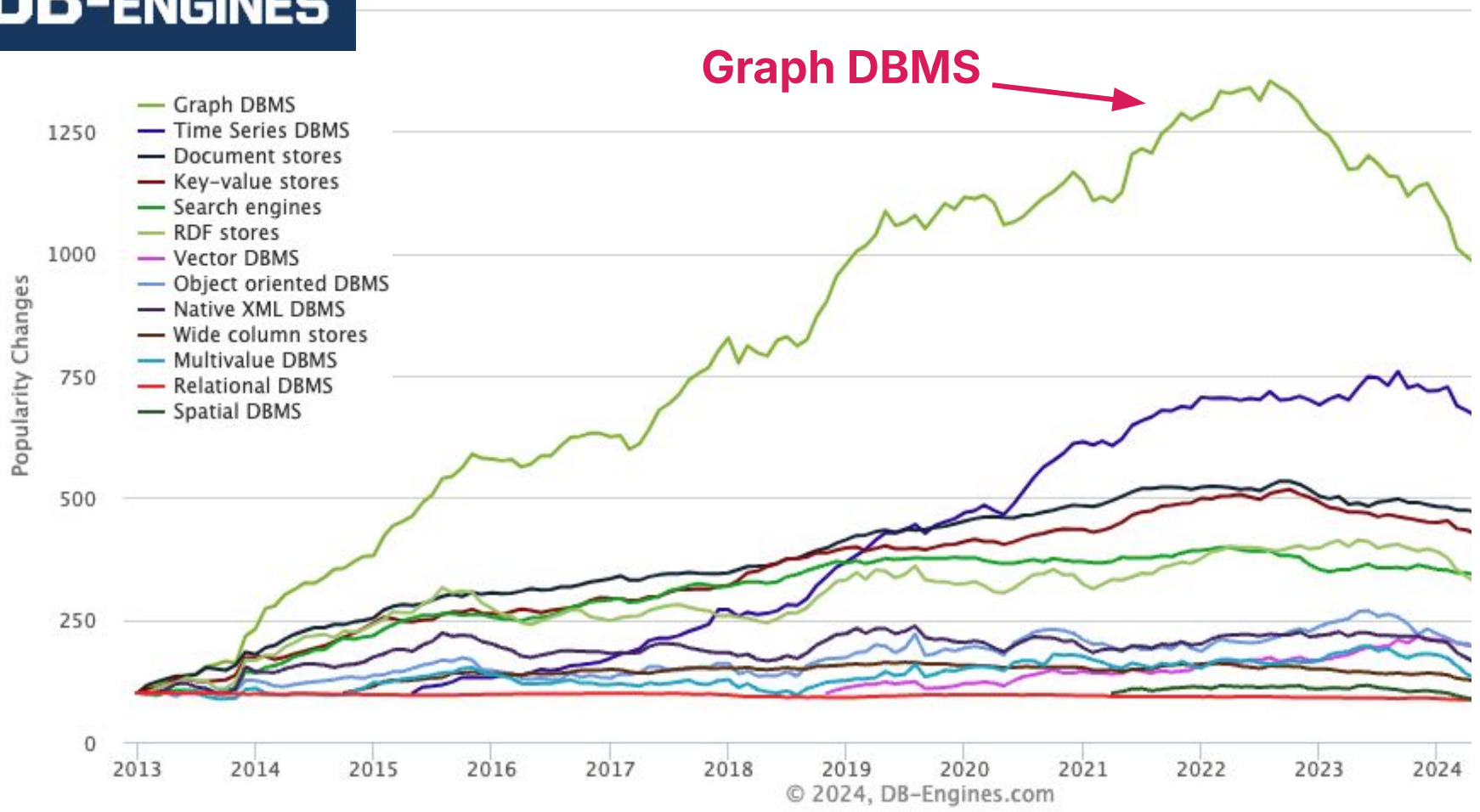
Better Predictions
Feature engineering
KG completion

Advanced Investigation
Integrated algorithms
Interactive exploration

Google CATERPILLAR® NASA ebay Goldman Sachs Microsoft in IBM aws AstraZeneca

Metrics and Markets

DB-ENGINES


Graph DBMS
Graph DBMS
Time Series DBMS
Document stores
Key-value stores
Search engines
RDF stores
Vector DBMS
Object oriented DBMS
Native XML DBMS
Wide column stores
Multivalue DBMS
Relational DBMS
Spatial DBMS
Popularity Changes
1250
1000
750
500
250
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
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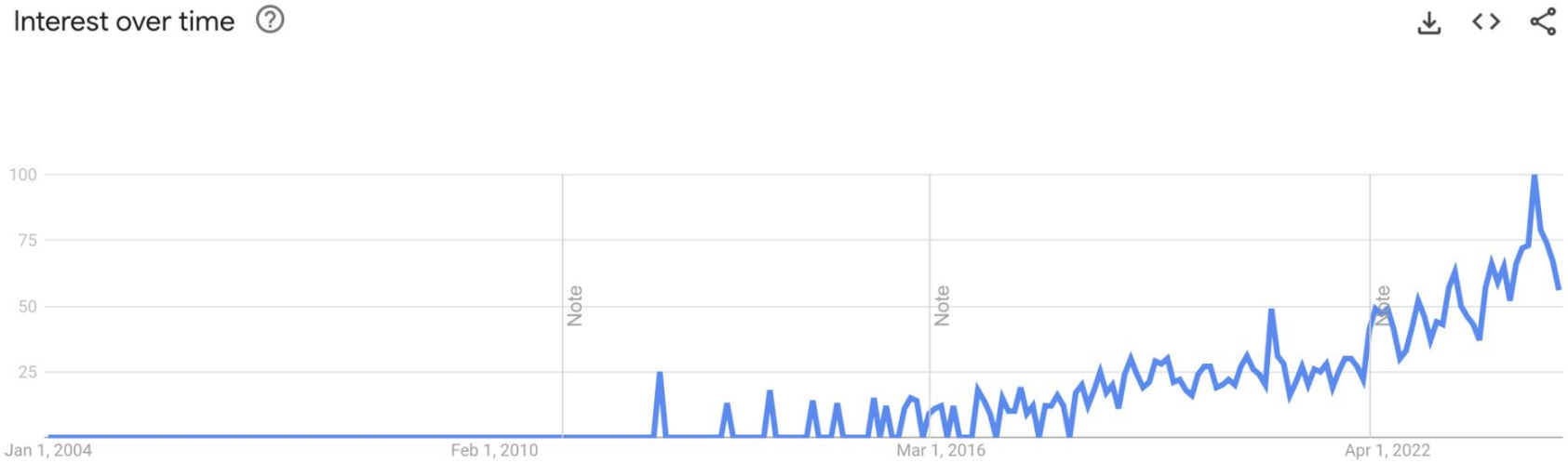
Knowledge Graph Search Trends Since 2004

United States | 2004 - present | All categories | Web Search



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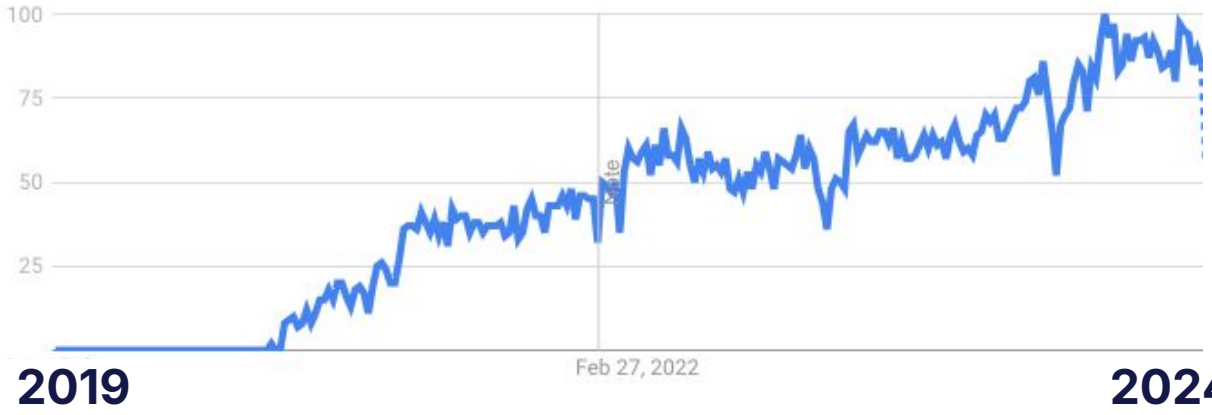
Knowledge Graph Search Trends - Last 5 Yrs

World Wide

Interest over time



Related queries

1	llm knowledge graph
2	rag
3	chatgpt knowledge graph
4	langchain knowledge graph
5	gnn

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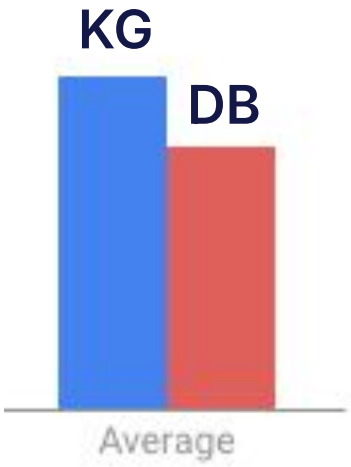
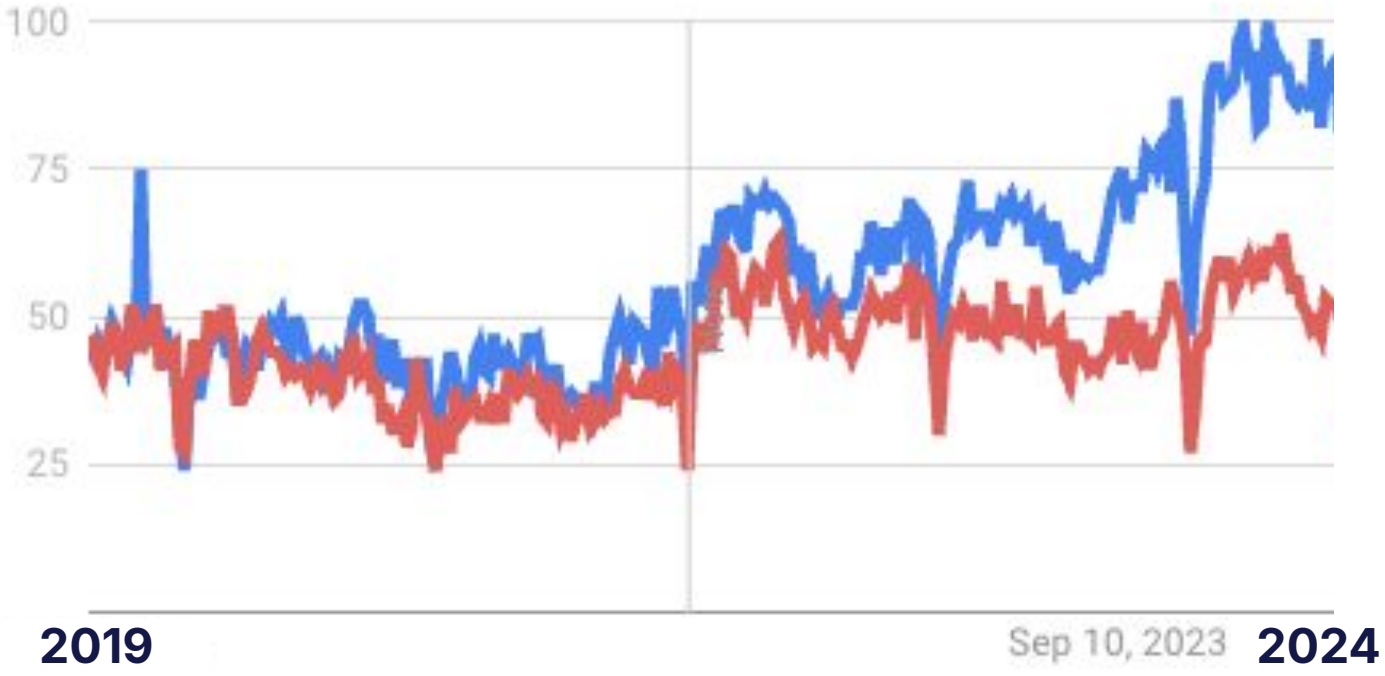
Knowledge Graph vs Graph Database (5Yrs)

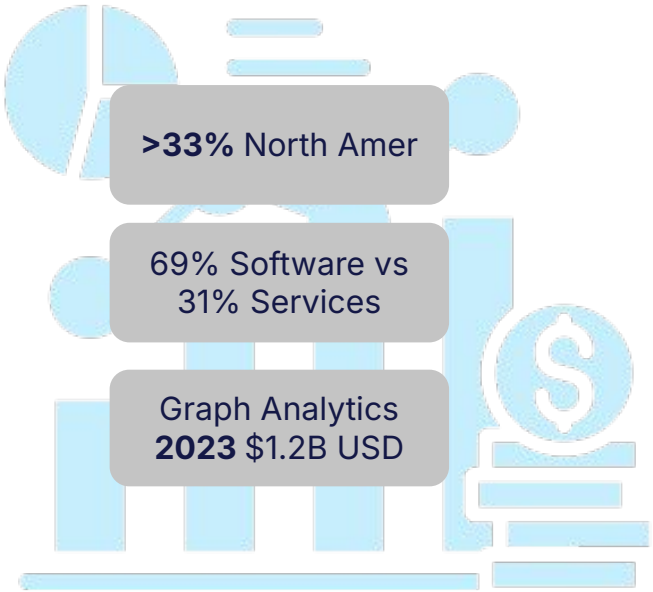




Graphy Startups and Investments Surge

Coming Soon!

Market Size? Depends on Definitions



Graph Database **2023** $2.9B USD	Graph Database **2028** $7.3B USD	Too High
Knowledge Graph **2023** $.9B USD	Knowledge Graph **2028** >$2.4B USD	Too Low
IMHO Rational Estimate **2023** $1.4B USD	IMHO Rational Estimate **2028** $4.8B USD	

https://www.marketsandmarkets.com/Market-Reports/graph-database-market-126230231.html
https://www.marketsandmarkets.com/Market-Reports/knowledge-graph-market-217920811.html
https://www.databridgemarketresearch.com/reports/global-graph-analytics-market
https://www.imarcgroup.com/graph-database-market

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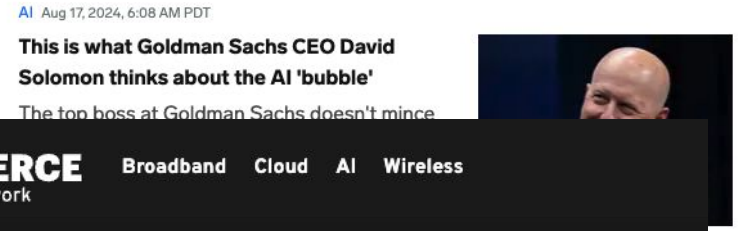
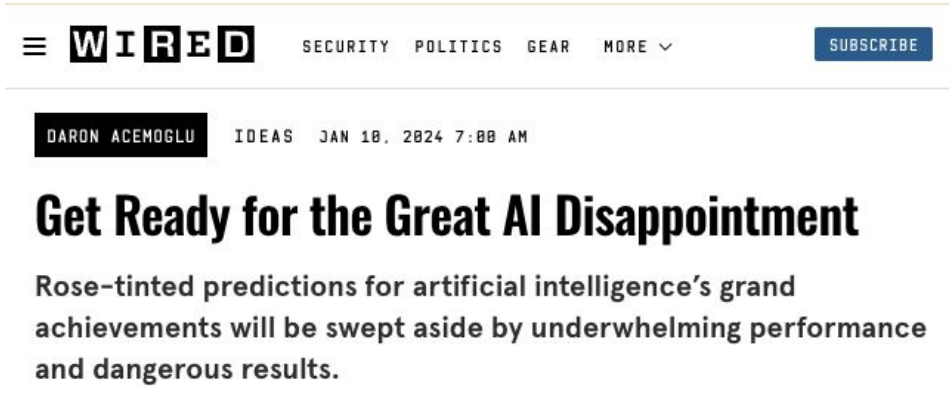
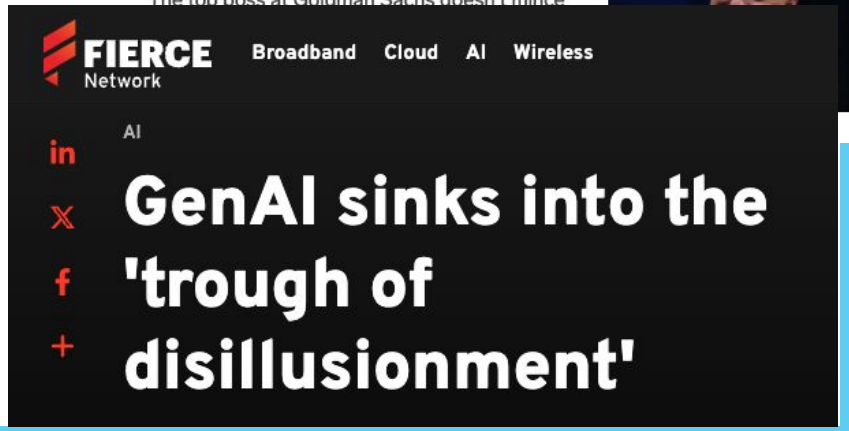
What's Driving Interest?

GenAI - Promise, Disaffection, and Promise

- Skepticism is the norm
  - Considerable effort /costs
- Eye-candy announcements and demos
- Shortcomings better understood
  - Fueling interest in Knowledge Graphs (deterministic & more mature)

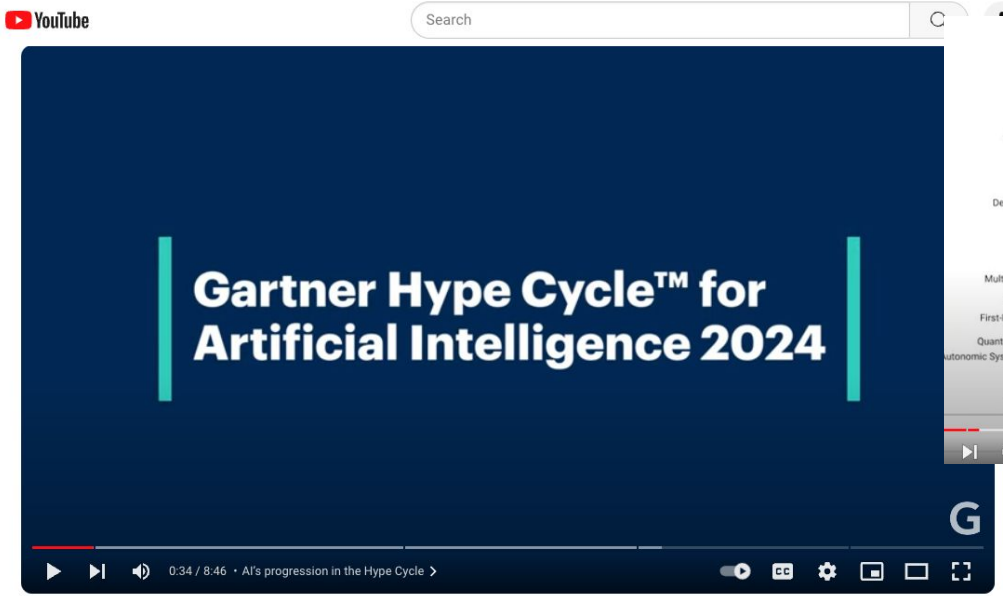


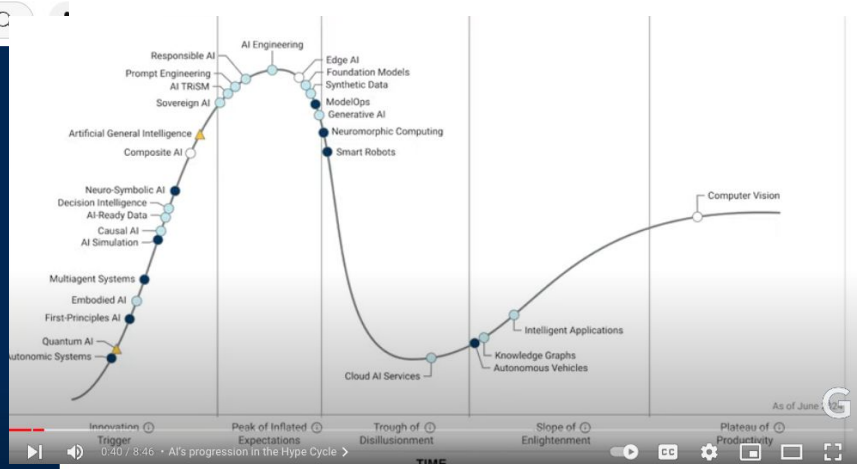




KG Matures in Comparison to GenAI

GenAI is sliding into the trough of disillusionment while Knowledge Graphs have made it out and are in the slope of enlightenment!





Gartner clients, see the full 2024 AI Hype Cycle:
https://gtnr.it/4cVAup1

https://www.youtube.com/watch?v=qXKYOR3KqxQ

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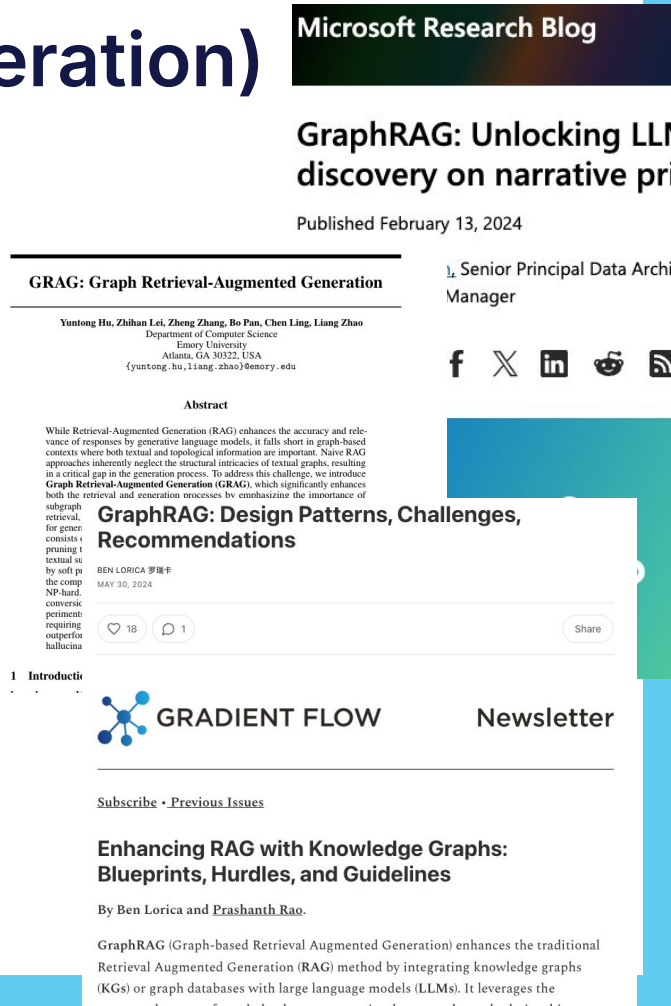
RAG (Retrieval-Augmented Generation)

340 papers on RAG in from Jan-Jun 2024!!

- Better performance and accuracy of LLMs
- Less hallucinations
- More contextual understanding
- Adaptability and customization to specific domains and proprietary data
- Multimodal capabilities

Check Out

- Smart search app on Epsilla for searching RAG papers https://lnkd.in/g2vuJCQh
- Ben Lorica and Prashanth Rao Recommendations https://gradientflow.substack.com/p/graphrag-design-patterns-challenges



Microsoft Research Blog

GraphRAG: Unlocking LL
discovery on narrative pr

Published February 13, 2024

1, Senior Principal Data Archi
Manager

GRAG: Graph Retrieval-Augmented Generation

Yuntong Hu, Zhihan Lei, Zheng Zhang, Bo Pan, Chen Ling, Liang Zhao
Department of Computer Science
Emory University
Atlanta, GA 30322, USA
{yuntong.hu,liang.zhao}@emory.edu

Abstract

While Retrieval-Augmented Generation (RAG) enhances the accuracy and relevance of responses by generative language models, it falls short in graph-based contexts where both textual and topological information are important. Naive RAG approaches inherently neglect the structural intricacies of textual graphs, resulting in a critical gap in the generation process. To address this challenge, we introduce **Graph Retrieval-Augmented Generation (GRAG)**, which significantly enhances both the retrieval and generation processes by emphasizing the importance of

v:2405.16506v1 [cs.LG] 26 May 2024

GraphRAG: Design Patterns, Challenges, Recommendations

BEN LORICA 罗瑞卡

MAY 30, 2024

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Enhancing RAG with Knowledge Graphs: Blueprints, Hurdles, and Guidelines

By Ben Lorica and Prashanth Rao.

GraphRAG (Graph-based Retrieval Augmented Generation) enhances the traditional Retrieval Augmented Generation (**RAG**) method by integrating knowledge graphs (**KGs**) or graph databases with large language models (**LLMs**). It leverages the

Standard RAG

Relies on embeddings and vector databases to find similar content

Focuses on similarity scores for individual sentences

Generally simpler to implement and faster for retrieval

Suitable for general Q&A systems and straightforward information retrieval

Graph RAG

Uses graph structures without relying on embeddings

Fuller understanding of data & relationships between entities

More complex, requiring knowledge graph maintenance

Suited for complex scenarios involving structured knowledge and contextual understanding

Graph RAG Improves Results but ...

LinkedIn uses Graph RAG to cut customer support resolution time by 29.6% https://arxiv.org/pdf/2404.17723

Sequeda & Allemang updated previous work to reduce error rates by 20% https://arxiv.org/pdf/2405.11706

Building a knowledge graph is a challenge
Garbage In → Garbage Out
Need better metrics
Need continual care and feeding

Tomaž Bratanič and Oskar Hane: Knowledge Graph-Enhanced RAG www.manning.com/books/knowledge-graph-enhanced-rag

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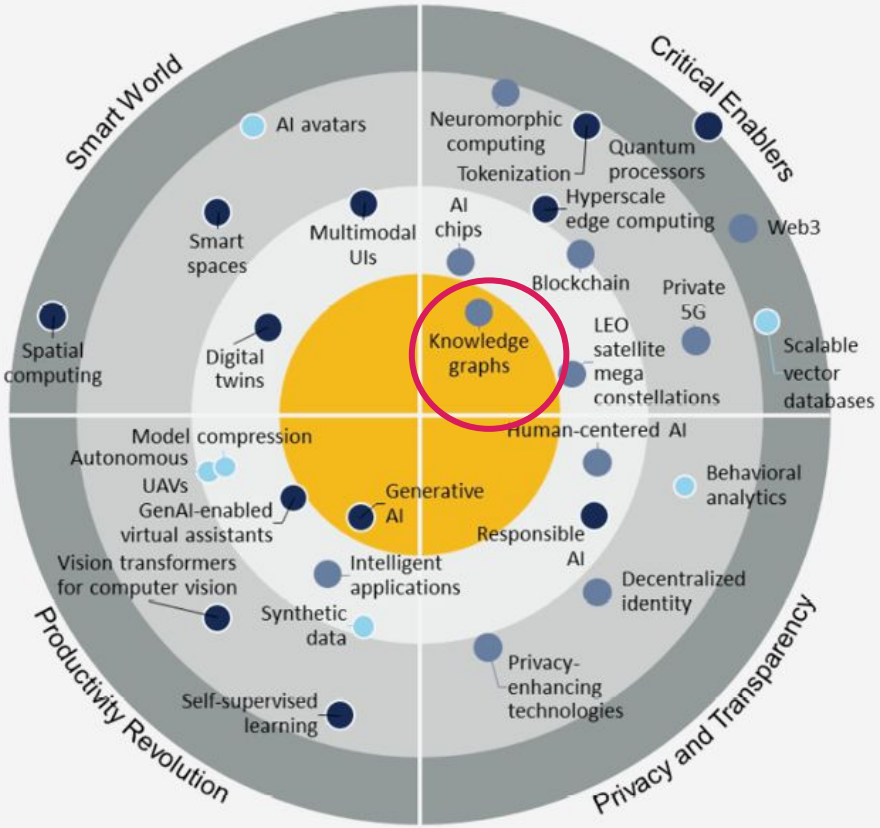
Gartner recently published a list of 30 emerging technologies identified as critical for product leaders to evaluate as part of their competitive strategy

Impact Radar for 2024



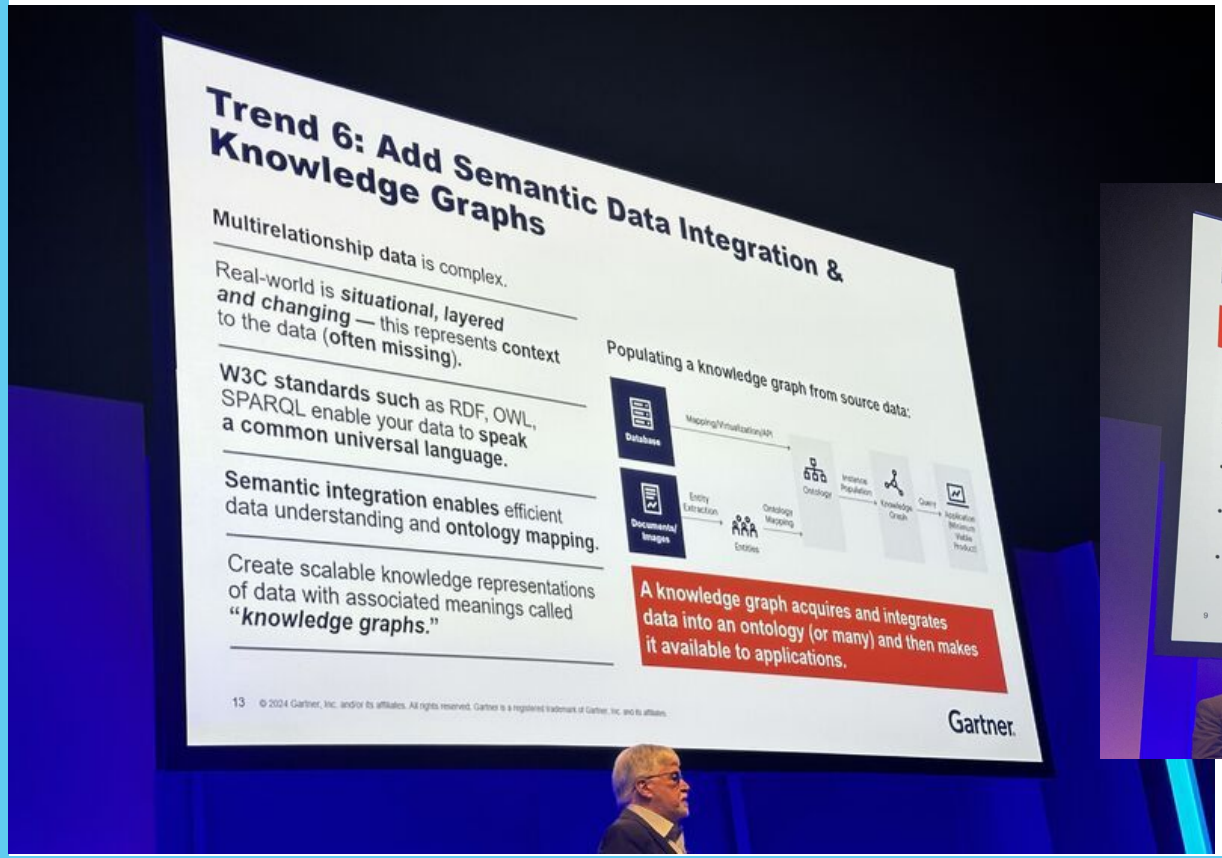
Range
- 6 to 8 Years
- 3 to 6 Years
- 1 to 3 Years
- Now (0 to 1 Years)

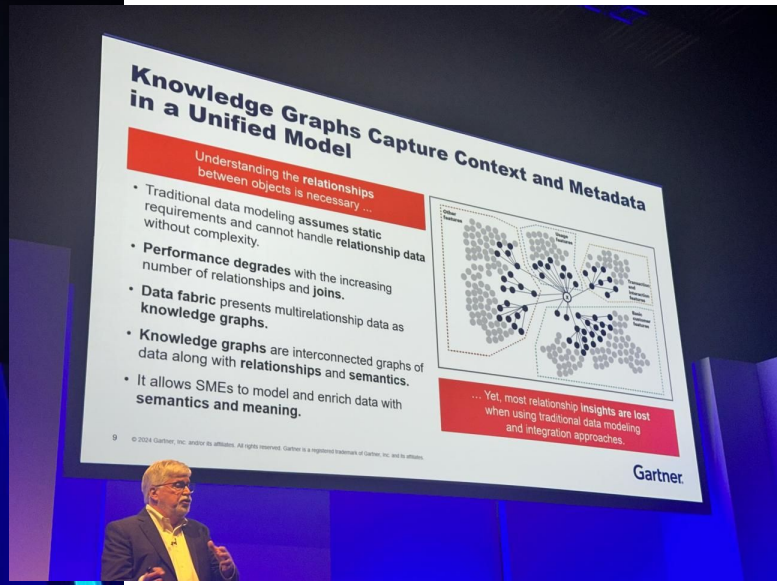
Mass
- Low
- Medium
- High
- Very High

Source: Gartner

Gartner

Semantics: Top 10 Trend in Data Integration and Engineering





Presented by Mark Beyer at Gartner D&A London

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What's Next?

KG Challenges We (still) Have to Address

GraphRAG Disappointment
Garbage In → Out
Unexpected effort
Productization
and maintenance

Quality Measures

Graph Modeling
Needs expertise
Many choices
Specific to use

Lack of Expertise
Graph experience
(different types)
Domain SME
Ontology/Schema
Dunning Kruger effect

Not Fluid
Lack of interoperability
ETL/ELT needs auto
Transforms are onerous
Hard to blend data

Lack of Critical Mass
Emerging standards

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Knowledge Graph Themes in 6 Months!

Practical Workflows: Paco Nathan
Constructing KG from Unstructured Data
https://www.youtube.com/@graphgeeksorg

Hybrid RAG: *Integrating Knowledge Graphs & Vector*
. . . https://arxiv.org/abs/2408.04948

Improved natural interfaces
Blending KG & analytics
BI Like capabilities

Knowledge Graphs reinvigorate expert systems?

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Undercurrents to Watch

Graph Frameworks

Databases vs engines (and?)

RDF+ LPG stacks

Big & small graphs

Unstructured and relational data

De-Evolution of Query Languages

Driving languages lower; usability?

Mixing declarative and procedural

GQL/PGSQL but now what?

AI & Graphs

FLIP: AI → KG

Automated quality measures

Graphs+vectors

Causal graphs & what-if analysis

GNNs + KG

Graph BI

New abstractions

Mixing data models

Fluid data transformations

Streaming updates

Hidden and seen graphs

Advanced Graph

~~HyperGraphs~~

Temporal

Geospatial

HDGraph

Neuromorphic

GraphGeeks

Vendor-Neutral Graph Community

GraphGeeks

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amy.hodler@graphgeeks.org